THE AMERICAN JOURNAL
OF
OPHTHALMOLOGY.

VOL. XXIII. APRIL, 1906. No. 4.

ORIGINAL ARTICLES.

DISCUSSION OF DR. COLBURN'S PAPER.*

Dr. L. A. W. Alleman (Brooklyn): I owe you an apology for opening this discussion. I was not informed that I was to open it until I was in the country, and away from my books. Personally, I have no experience with the operation. I have seen some cases corrected by lenses, but have never had an operative case, and I feel that I have learned much in listening to this excellent paper, but have nothing to contribute to its discussion.

Dr. Mark D. Stevenson (Akron, Ohio): I have found the results of capsular advancements very gratifying in most cases of paralysis of a rectus muscle. The eye is fixed in the middle line, and the limited rotative power is more or less compensated for by the movements of the head and neck. Such operations should not be performed until other measures have been tried and ample time —one year or more—has elapsed. If the compensatory head and neck movements are sufficient in such cases, they should also be so in cases of nystagmus where the vision of both eyes is nearly always very defective. It would seem very good practice to fix such eyes with strong capsular advancements.

Dr. Valk (New York): This method of Dr. Colburn seems very similar to the method employed some time ago by Agnew with the guy in an operation for strabismus; a suture was put into the conjunctiva and then passed through the skin at the external

*See March number of this journal.

canthus, and the eye tied out in that way. It seems to me there should be a very good result in Dr. Colburn's method of operating. With reference to nystagmus, I hardly think the operation would be of service, if it is due to central causes, but if it is due to the want of motility or a refractive error, it might be very serviceable, as the only objectionable feature would be the decided reduction in the motility of the eye, and the diplopia in the outer parts of the field.

DISCUSSION OF DR. BERNSTEIN'S PAPER.*

Dr. Weeks: I will speak very briefly of the method of advancement I employ, which is not original with me by any means. I have perhaps modified some of the steps of the procedure. A linear opening is made through the conjunctiva, over the insertion of the rectus tendon, extending beyond the margins of the tendon and the conjunctiva and the subconjunctiva tissues are dissected backward. The center of the tendon at its insertion is divided, leaving the lateral extremities attached. Then a pair of slotted fixation forceps, with opposing blades that are supplied with teeth, is inserted and the loosened end of the tendon, the conjunctiva and subconjunctival tissues are seized. The forceps are almost as wide as the tendon at its insertion, and thoroughly control the tissues. Then the sutures, each of which carries two needles, are passed through from beneath the muscle. The two needles of the middle stitch are passed through well back, as far as is necessary to produce the effect desired, and 1 mm. to either side of the middle of the tendon. One of the needles is then returned, so as to pierce the whole of the tissues at the middle of the tendon, making a "quilting" stitch, and passing beneath ocular conjunctiva, it enters the scleral tissue about 2 mm. from the corneal margin, and emerges at the sclero-corneal junction in the horizontal meridian. Before beginning the operation the horizontal meridian is marked on the conjunctiva, near the corneal margin, so that in returning this needle we have a guide to follow. The lateral sutures are now inserted, the "quilting" or the "simple" stitch being employed, as the operator may elect. The scleral ends of the sutures are brought on a line tangential to the margin of the corneal meridian pierced by the middle suture. After the sutures are passed through the tendon, the tissue that is grasped in the forceps is cut

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***See March number of this journal.**

away and the forceps are liberated. I neglected to say that the lateral attachments are divided after the tendon is grasped in the slotted forceps. The middle suture is tied first and then the lateral sutures. The attachment to the globe is a broad one. It is not my custom to confine myself to advancement, although I am doing it more of late than tenotomy. In many cases the tendon of the opposing muscle is divided wholly or in part. I do not agree with those who think that partial tenotomy cannot produce any permanent effect. In heterophoria it is my custom to measure the strength of the individual recti muscles, which can be done with sufficient accuracy with the tropometer designed by Stevens. A number of measurements are necessary to determine which are the stronger and which are the weaker muscles. In many cases one will find that one rectus muscle is actually stronger than the others, and if we are going to do a tenotomy the muscle is indicated positively. As a consequence the surgeon can operate with the assurrance that he will benefit the patient.

Dr. Colburn: The question of advancement has been of great interest to me. I have used various forms of advancement. I am inclined at present to use one that I have once or twice described. My preference is for a combined operation of section and tucking, which is really shortening of the tendon, and not an advancement. The operation I prefer is described as follows (Fig. 9): Open the conjunctiva just anterior to the tendon attachment, dissect backward, making a tongue-shaped flap. Grasp the tendon and make a buttonhole extending across the attachment, with the exception of a narrow band of fibers on either side, as in graduated tenotomy, K. K. Split the tendon through its center as far back as is desired to secure sufficient shortening, H. H. You now have a T or Y shaped incision in the tendon. Introduce a suture posterior to the opening in the distal end of the incision in the tendon; re-enter the sclera at the cut end of the tendon, and bring the needle out at I, introduce two sutures at M and L M'. L'. Tie first the central suture, then the lateral sutures. The operation is simple. No special instruments are required, and there is no danger of displacing the tendon. There is no deformity following the operation. The dosage is accurately determined. There is no permanent thickening and the results are certain.

Dr. Valk: I would ask Dr. Colburn why he does not use catgut instead of silk.

Dr. Colburn: Because the gut does not tie as readily, and does

not stay put where I want it. I have tried the various preparations of gut, but cannot depend on my stitch.

Dr. Valk: How long do you keep them in?

Dr. Colburn: Five to seven days, if I see no sign of trouble.

Dr. Mark D. Stevenson (Akron, Ohio): An advancement, alone or combined with a tenotomy, is practically always to be preferred to a tenotomy. Weak and not too strong muscles are usually dealt with, and the operation should strengthen and not weaken a muscle. A careful study of the Y shape of the muscle, tendon and check ligament will make clear why an advancement will increase rotation, and not diminish it, as a tenotomy does; also why advancement of the capsule forward will not tend to limit the rotation of the eye to the opposite side, whereas tenotomy will limit rotation toward the side operated upon. Tenon's capsule pushed well back on the muscle or tendon can afford considerable support to the suture, and because of its great elasticity will not limit, ultimately, the rotation of the eye to the opposite side. Good anchorage in the sclera can nearly always be obtained, but unless the suture is looped on the muscle or tendon it is likely to cut its way through between the fibres. If the capsule is included in the suture, it prevents much bunching of the muscle, which can also be partly avoided in my operation by placing the two scleral anchorages a good distance apart. A strong, broad attachment results. My operation is a modification of Worth's and is fully described in the *Journal of the American Medical Association*, Sept. 9, 1905.

DEXTROPHORIA.*

By FRANCIS VALK, M.D.

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In my treatise on Strabismus, latent and fixed, issued last year, I made his remark, in regard to the classification of squint:

"To these conditions I would add certain tendencies of the eyes to turn to the right or left, in which, by the examination, we find a weakness of one internus and of one externus, giving a tendency to look to the right or left. I do not propose to suggest any special terms for this condition, but, as I have met some cases, prefer to note it in this classification and to explain it under the subject

*Read at the 10th annual meeting of the American Academy of Ophthalmology and Oto-Laryngology, Buffalo, Sept. 14th to 16th. 1905.

of heterophoria." Furthermore, on page 84, writing on Anaphoria, we find: "There are still other cases that may come under this classification, not infrequent, in which we have a tendency of both visual lines to turn the same way but laterally, in other words they tend to turn to the right or left. I have no terms to express this condition, nor do I think any have been suggested, but these cases are occasionally met with in an examination. Stevens has suggested that it is due to a condition of cyclophoria. I have not convinced myself that that suggestion is correct, but I am inclined to look upon all these cases as due to the same conditions as in all other cases of squint, that is to say, we have an essential weakness of one internus associated with a similar weakness of one externus, hence the tendency to look in one of the two lateral directions."

I do not know of any terms more suitable to express this condition of muscular imbalance than the one which I use as the title of this paper, while, in a case of a tendency of the visual lines to turn to the left, Lævophoria, suggests itself, at the same time it is a question in my mind as to the proper designation of this condition, hence the reason that this paper should be presented to this Society.

It is very true that if we study the imbalance presented by these cases and consider the results of our final examination, we will always find them complicated with—or, perhaps, they are a complication of—other conditions of heterophoria. The usual popular tests will show either Esophoria or Exophoria, and if so, then we may say that the lateral imbalance is complicated by this tendency to turn the eyes in a certain direction, as to the right or left. All this I think we can prove to be true, and, as I understand this condition, if we do have this complication its value is apparent, as it renders the mode of procedure much more simple in the treatment of all cases of lateral imbalance, either by exercise, by prisms or by an operation.

It is interesting, in connection with this subject, to note the position, in which objects are held when we look at them naturally. If we pick up an object and look at it, and we then notice the position of the object which comes most natural to us, it will be found directly in line with the mid-plane of the body. Furthermore, we find the base line of the eyes, that is, an imaginary line drawn from the center of rotation of one eye to the center of rotation of the other eye, at right angles to the mid-plane of the body. Then if we naturally hold an object in line with this mid-plane—a position analogous to that of the finger in pointing—it must be

in a line with the middle of the base line between the eyes. Now, for the near point, the visual lines should be in the position of mutual balance between the eyes, and when the look is in infinity, the visual lines would be in the well-known position of rest. This position of holding an object in the midplane has been noticed and verified in the "one eye blind," and seems to me to be a simple physiological act ordained by nature. To resume, then, if we accept this explanation of our natural position for the visual lines, and we have the condition of dextrophoria present, it almost goes without saying, that we must have more or less strain on the weak internus of the right eye, and on the weak externus of the left eye, which must call for greater innervation of these individual muscles to hold the image of the object fixed upon the macula of each eye. Hence it seems justifiable to state that these persons must suffer, more or less, from certain symptoms caused by this imbalance of the ocular muscles, and it is also evident that at the natural position of the look the eyes cannot be at rest in dextrophoria, except when they are slightly turned to the right or the head slightly turned to the left, both of which are unnatural positions. Moreover, if the eyes are under this condition of strain when the look is fixed upon an object, we can readily understand how much greater the strain must be on the innervation of the ocular muscles in the act of reading. It has been fully proved by the investigations of Dodge, and others, that the eyes must be perfectly stationary for an image to form on the macula—we are practically blind when the eyes are moving from point to point—and so in the act of reading the eyes are constantly moving and constantly stopping, as we read along the line of our book, and so constantly demanding an excessive nervous impulse upon these anatomically weak muscles.

As to the etiology of this condition, it seems to me very simple, as it must be due to the anatomical conditions only. If myopia and other conditions of the ocular apparatus may be inherited from the parents, and I believe many cases are so inherited, then an inbalance of the muscular apparatus of the eye in a parent may be shown in a child, though not necessarily of the same character. I have noticed an exophoria well marked in a mother, whose child showed the condition of esophoria, and in other cases this tendency of the eyes to turn in a lateral direction. We may also note it in the history of some of our cases when the mother states that the child when young had "a cunning way" of turning the head to one side when speaking to others. These children, when examined

later, will show this tendency to turn the eyes to the right or left, and their "position of rest" with the look in infinity becomes one with the finite point removed to the right or left from the extended midplane of the face. Hence, the visual line of the "cyclopean" eye, if such an eye could exist, would not be at right angles to the base line drawn from the centers of rotation of the two eyes, but would lie in a direction to the right or left. We may then conclude that this condition must be anatomical, and due to a weakness of certain muscles that are associated in the conjugate movements of the eyes—in other words, a weak internus associated with a weak externus of the fellow eye. As to what is the actual condition, anatomically, we must leave that to the operation to demonstrate, as we may have a faulty insertion of a tendon into the sclera, one of the opposing muscles may be too long, or too short, or one may be too largely developed, as compared with its antagonist. I cannot consider this condition in any other way, as I fail to appreciate what influence innervation of the muscular apparatus or the accommodation can have to do with this tendency of the visual lines in these directions. I have a letter from Dr. G. T. Stevens, stating that he has also noted those cases, and in which he suggests that it is probably due to cyclophoria, but I have not observed this condition in any of my cases.

Diagnosis: Ellett, in the *Journal of the Am. Med. Association,* Oct. 18, 1902, in his classification of the ocular movements of the eyes refers to the associated conjugate movements as versions, and suggests the names of dextroversions, lævoversion, superversion and subversion. Accepting these associated movements of the two eyes conjointly, we find that Stevens had demonstrated that we may have an abnormal condition of the vertical movements of the eyes, as if, the superversion is too great, more or less, equally, we have Anaphoria, and conversely if the subversion is greater than normal, we have Cataphoria. Here we have two distinct terms that indicate an excess of rotation in the vertical meridians of the eyes, and if so, and from the same anatomical reasons, may we not have the same excess of rotation in the lateral meridians or horizontal plane? I think that I may so state that these cases do exist, as I shall try to illustrate, and the names or terms I have suggested seem to me the most suitable for that purpose. A decided tendency of the associated visual lines to turn to the right would indicate Dextrophoria, and if to the left, Lævophoria.

Accepting the presence of this condition of an abnormal direction of the associated visual lines, the question of diagnosis becomes

very important. I think that I may state that none of the usual tests for heterophoria will indicate this condition. It frequently exists more as a complication of Esophoria and Exophoria, in which a slight turning of the head to the right or left will at once render negative any evidence of this associated turning of the visual lines. Anaphoria and Cataphoria present the same conditions as regards the diagnosis, and these conditions are rendered negative by the subjects placing the head in an abnormal position, that is, either forward or backward, so as to correct the inbalance. Now this vertical tendency shows the same difficulty in a diagnosis as this lateral tendency, and it seems to me that we have only one method, and only one instrument of precision, by which this can be measured and the diagnosis made. This must be done then by careful measurements of the rotation of the eyes in the field of version. The perimeter will *not* give these masuremnts with sufficient accuracy, on account of the prominence of the nose, which interferes with the correct measurements of the full extent of the inward rotation. The tropometer of Stevens will give these measurements with almost perfect accuracy, and, in my judgment, is one of the most valuable instruments in the office of the oculist. In the measurements of the rotation of the eye, in all and every direction, this valuable instrument gives us an extremely useful objective examination, that can be quickly recorded and readily compared with the normal rotation of the eye. I cannot speak too favorably of the work I have done with the tropometer, as in many ways it has cleared up the diagnosis in some very obscure cases, and has clearly pointed out to myself the best method of procedure in the case then under consideration. The extent of the normal field of rotation or version seems to vary, according to the findings of other observers, but I think if accurately taken with this instrument, it will be found, in round numbers, about 35° upward; 50° downward; 55° inward; and 50° outward. A rotation of the eyeball about its center of rotation, such as this, is perfectly normal; it is sufficient for all the purposes of life, and is a very clear indication of the absence of any heterophoria. I cannot conceive of any imbalance of the ocular muscles when the tropometer will show this normal rotation in the field of version. It becomes self-evident, then, that if this instrument may show a decided change in this normal field, that the measurements show a weakness of one internus and a corresponding weakness of an externus of the fellow eye, it must indicate a tendency of the eyes, in their associated movements, to turn to the right, Dextrophoria,

or to the left, Lævophoria.

Now, in the examination of cases of fixed squint, either of the first or second class—that is, either with or without amblyopia—this condition of the rotation of the eyes is never found, as in my experience, the examination of the field of version, in all cases of convergent squint, will show a decided want of outward rotation of the eyes, with probably an increased inward rotation associated with it.

Symptoms and Their Diagnosis: Linnell writes of an ophthalmoplegia which affects the muscles of the eyes concerned in the conjugate movements, as that of the externus of the left eye and that of the internus of the right eye, and in which the patient would turn the eyes to the right, but in all these cases we must have a certain diplopia from the want of innervation to the muscles, while in the cases concerned in this paper we do not have diplopia, unless it should be due to traumatism, as from too frequent or too free operations on these muscles, nor do we have any fixed deviation of the visual lines to the right or left, but only a tendency for the eyes to turn in either of those directions, which can only be demonstrated by a careful examination in the field of version. A conjugate paralysis is not a dextro- or lævophoria; one is due to an intercerebral or cortical origin, and the other, in my opinion, to an anatomical fault. Savage writes of a conjugate center to turn the eyes to the right or left, but when the eyes are in the primary position the muscles are not innervated, they are simply in a state of tonic contraction, that is, a normal condition, and does not tend to cause any symptoms of eyestrain.

There are no special symptoms that would indicate this tendency for the eyes to turn to the right or left, but all these cases present the usual history of asthenopia associated with certain reflex conditions usually found in cases of esophoria and exophoria, particularly pain passing backward toward the occiput, nausea, carsickness and dizzy sensations, with frequently a pulling sensation about the eyes, etc. In many cases they are much improved by the use of glasses, by which we have a full correction of the refractive condition, under atropine, if necessary; but in some of our cases, in a short time, the glasses fail to give the desired relief, and the distress is still in evidence.

What are the indications that we may understand from this condition of the visual lines? That question will be fully decided by other tests, which may indicate what special condition of lateral inbalance may be present. Take as an illustration, a well-marked

case of dextrophoria, as shown by the tropometer; here we have a weak internus of the right eye, and a weak externus of the left eye, giving a natural tendency of the eyes to turn to the right, but possibly held in the first, or natural position, of the visual lines by an excessive innervation directed to these weak muscles under the direction of the guiding sensation or fusion force. Then, if associated with this, we find by the application of the other tests, as Maddox rod, phorometer, or the prism test, a condition of esophoria or exophoria, the usefulness of the diagnosis and the indications for the management of these cases becomes apparent. To continue the argument, if we find a condition of esophoria associated with either dextrophoria or lævophoria, then the essential fault must reside in the weak externus of the right or left eye, respectively; on the other hand, if we find an exophoria associated with the same condition, then it becomes evident, from the same reasoning, that the essential fault must be in the weak internus, of the right or left eye, respectively. Savage writes of a center which controls the conjugate movements of the eye to the right or left. This has not been fully demonstrated yet by any investigator, but, even though these lateral movements of the eyes seem to be simultaneous, the tropometer proves that each visual line may move in an arc of different size in certain directions. In these cases we will find that the position of rest, when the muscles are not innervated, but the eyes held steady by their tonic contraction, is one in which the visual lines tend to deviate to the right or left, while that of the normally adjusted eyes is toward the midplane of the body, at a point situated in infinity.

Noyes and other writers speak of certain cases of muscular asthenopia in which we have a condition of esophoria at the distance, and exophoria at the near point of about twelve inches. That these cases do exist goes without saying, and when these cases have been noted the necessary procedure seems very uncertain, but if we accept the presence of dextro- or lævophoria, the indications become very much clearer. We have a weak externus, causing the esophoria when the look is in infinity, and a weak internus when the vision is fixed on an object placed at the near point.

Now, I have always considered that in all cases of heterophoria our means of correction should be first directed toward the muscular balance when the eyes are in the first position. Hence, after the refraction has been fully corrected and the glasses have been worn for a reasonable time, then, if we fail to relieve the existing

symptoms we must consider some operative measures for the correction of the muscular imbalance, if that is present. I here wish to state that I have very little confidence in the correction of any case of muscular imbalance by the means of prisms or the system of exercise of the ocular muscles by certain rhythmic movements. These procedures may seem to be of benefit for a time, but I believe the symptoms will soon return when the exercise is suspended and the former use of the eyes is resumed. There are certain conditions of low degrees of heterophoria, such as simple exophoria, that may be improved under the systematic use of muscle exercise combined with tonics, as strychnia, etc., but in the condition to which this paper refers they have completely failed in my own cases when faithfully tried. Having then decided that we can only improve this condition of imbalance by an operation, it becomes a question of much importance what operative procedure shall we institute? This is answered by the condition of heterophoria, shown by the tests with Maddox's rod, the prisms and the phorometer, and lastly by the location of the weakest muscle in the field of rotation. If we have esophoria, shown by the usual tests, then our attention must be directed to the weak externus. Conversely, if the same tests show exophoria, then the most essential fault must be in an excessively weak internus, and our procedure must be towards improving the power or tone of that muscle.

Treatment: The true value of the diagnosis of this condition of dextrophoria is shown when we come to the operative procedure that is necessary in certain cases of heterophoria, as we should now be able to note the indications for our operative interference. It goes without argument, that, if our cases of imbalance of the ocular muscles have been carefully examined, the refraction correctly adjusted with glasses and a reasonable time having elapsed, yet they have not been relieved of their symptoms of asthenopia or eyestrain, then the consideration of the muscular imbalance must engage our attention. As before stated, I do not have much confidence in the exercise procedure or the use of prisms, as the results are only temporary, or, in many cases, they fail to give any relief and if they do have some beneficial effect, it means wearing glasses when they could do better without them, as some of my cases preferred to have a suitable operation. I would illustrate this by the two following cases from my books:

Mrs. J. B. Age 30. Has exophoria of 5° with dextrophoria. V.=$^{20}/_{15}$. Refraction emmetropic. Wearing prisms of 2° over

each eye relieves the symptoms of eyestrain, but she does not wish to wear these glasses, and will not do so. Her adduction is about 20°, her abduction about 10°. The tropometer shows a tendency of the eyes to turn to the right, as R. E. 45° in; 50° out. L. E. 50° in; 40° out. Now, I do not think a tenotomy, either partial or complete, would be suitable in this case of exophoria, but considering the condition of dextrophoria, a shortening of the internus of the right eye would completely restore her muscular imbalance, correct the exophoria, and the tendency to a deviation of the visual lines to the right, so that the glasses might be dispensed with. Also Case 3823. Mr. H. H. R. Age 33. Has all the symptoms of asthenopia, both refractive and muscular. He has simple hyperopic astigmatism of 1 D. ax. 90°, each eye, with normal vision $^{20}/_{15}$. His refraction has been fully corrected with glasses, and these consistently worn for six months with some improvement in the symptoms. Two years before coming to my office he had been operated upon six times by repeated tenotomies without any improvement in his condition. Repeated examinations show esophoria with add. 25° and abd. 1°, with homonomyous diplopia with a red glass placed before one eye. The tropometer shows R. E. 40° in; 45° out; L. E. 55° in; 40° out. Judging from this, a shortening was done on the left externus, and three months after we have complete cessation of the asthenopic symptoms. Add. 15°, abd. 6°, and tropometer shows R. E. 48° in; 45° out. L. E. 50° in; 45° out.

Taking these cases as fair examples of them all, our true value then is shown in the indications for our operative procedure. For, if we have an exophoria with dextrophoria, we must have one of the externi weaker than normal, and that would contra-indicate a tenotomy of an externus. Furthermore, in a case of esophoria with dextrophoria, we must have a weakness of one of the intern and again a tenotomy is contra-indicated. Following the same line of argument, we then have a clear understanding that, in cases of lateral imbalance complicated with a tendency to turn to the right or left, a strengthening of a muscle must be the first indication for any operative treatment. I have frequently written of my method of shortening the straight muscles of the eyes, which has been published in reprints and in book form, and having performed the operation for various conditions of ocular deviations, and tendencies to deviate, in over four hundred cases, I can speak with confidence of the final results in this procedure. The operation is not difficult, it is readily performed under the use of

cocaine, its technique is simple, and its effects are lasting, as it improves the rotation of the eyes as cicatrization takes place. I have records and reports from cases operated upon some years ago, and in nearly all of them the improvement has been permanent with no return of the imbalance or complaint of the previous symptoms. In reference to the usefulness of this operation, I take the liberty of quoting from a private letter to myself from Dr. J. M. Banister, Major and Surgeon, U. S. A., whose name is well known in ophthalmic work in this country: "I use your method of advancement by tuck as a regular routine method, and have secured brilliant results with it. In cases of insufficiency of convergence, I take a 'tuck' in the internal rectus, without tenotomy of the externus, with results which was impossible under the previous ideas. Your operation is a great addition to my means of remedying muscular anomolies."

In conclusion, I give the histories of a few cases, in which the records will show the tendency of the visual lines to rotate to the right or left, as the case may be, and is well illustrated by the records taken from the examination with the tropometer. A careful study of the rotation of the eyes as shown in these cases will well repay the student of all muscular imbalance.

2157 Child, age 13. Periodic squint, V.=$^{20}/_{20}$ with glasses, refraction Hy. with Ah. Add. 30°, abd. 14°. Tropometer, R. E. 40° in; 50° out. L. E. 60° in; 30° out. With glasses no squint. Lævophoria.

3117 Miss H. W., age 25. Squint when child, tendency to diplopia. V.=$^{20}/_{15}$. Hm. .75. Exophoria 6°. Add. 12°, abd. 12°. Trop. R. E. 40° in; 50° out. L. E. 50° in; 40° out. Better with prism over right internus. Dextrophoria.

3588 Miss A. R., age 20. Head-pain and blur. V=$^{20}/_{20}$, Hy. 5 D. Esophoria, 2°. Add. 10°, abd. 10°. Trop. R. E. 40° in; 45° out. L. E. 50° in; 40° out.

3599 Miss M. H. G., age 28. Pain in the head constant and V. blurs. V.=$^{20}/_{20}$+. Ah. add. 15°, abd. 15°. Trop. R. E. 45° in; 50° out. L. E. 50° in; 40° out Advised operation.

3628 Miss S., age 28. Constant head-pain and cannot use the eyes; no improvement with glasses. V.=$^{20}/_{15}$. Ah. 90°. Esophoria 12°. Add. 30°, abd. 5°. Trop. R. E. 50° in; 55° out. L. E. 62° in; 45° out. Operation, shortening left externus, relief. Trop. R. E. 50° in and out. L. E. 55° in; 48° out.

3636 Mr. D. M. L., age 35. Nervous, cannot read and V. blurs. V.=$^{20}/_{20}$. R. My. L. Am. Add. 8°, abd. 4°. Trop. 40°

in; 50° out. L. E. 50° in; 38° out.

3724 Mrs. G. B., age 30. Pain back of head and neck; dizzy spells and nausea. V.=$^{20}/_{15}$. Hm. .75, exophoria 3°, add. 4°, abd. 10°. Trop. R. E. 45° in; 50° out. L. E. 48° in; 45° out.

3825 Mr. A. R., age 44. Pain over the eyes, shooting backward; cannot read. V.=$^{20}/_{15}$. Ah. 90°. Exophoria. Add. 10°, abd. 10°. Trop. R. E. 40° in; 50° out. L. E. 50° in; 45° out. Advised operation on right internus.

3862 Mr. T. F. W., age 25. Eyes red and painful vision blurs, and feels the strain on A. V.=$^{20}/_{15}$. Ah. ax. 180°. Esophoria. R. E. 50° in; 40° out. L. E. 45° in; 48° out. Lævophoria.

3886 Mrs. E. W., age 38. Nervous, nausea and cannot sleep, etc. V.=$^{20}/_{15}$. Hy. with Ah. ax. 90°. Orthophoria. Add. 10°, abd. 10°. Trop. R. E. 48° in; 50° out. L. E. 55° in; 48° out. Operation, shortening of right internus.

3892 Mrs. W. W. H., age 30. Pain goes backward from the eyes to the neck; pulling sensation. V.=$^{20}/_{15}$. Hy. exophoria 1°. Add. 15°, abd. 10°. Trop. R. E. 45° in; 48° out. L. E. 55° in; 40° out.

3905 Mrs. W. A. W., age 30. Head-pain, frontal, occiput, neck and back. Eye-strain. V.=$^{20}/_{15}$. Ah. ax. 90°. Exophoria 4°. Trop. R. E. 40° in; 50° out. L. E. 50° in; 40° out. Operation on R. Int.

The above cases are all that I found noted in my case books, as the records were taken from the last three hundred cases of refraction and motility. This is a small number noted that presented this anomoly, but as most of the cases were not examined in reference to this special condition, perhaps it might have been found much more frequently. Some of these cases might be considered as traumatic, as when examined they gave a history of having had more or less tenotomies performed without any relief. The majority of these cases seem to show dextrophoria, or a tendency of the eyes to turn to the right.

DISCUSSION.

Dr. Geo. M. Gould (Philadelphia): May I ask Dr. Valk as to the relative frequency of dextrophoria and sinistrophoria, the relative number of cases of each?

Dr. Valk: I think the vast majority are dextrophoria.

Dr. Gould: This interesting condition, which I have never

thought of before, until this minute, and did not even know what the term meant, has suggested to me a number of things. The doctor contends that we have here an anatomic condition. I think that heterophoria is not anatomic. I have not cut a muscle for heterophoria for a dozen years. None would cut the interni for 80 degrees of adduction power. But if a patient has 10 degrees of exophoria today, I can give him 80 degrees of adduction power in a week. Heterophoria, I think, is innervational in nature, and refractional in origin, and I therefore see no reason for tenotomy. During the reading of this paper a thought has struck me that may be somewhat illuminating. Throwing aside the idea that dextrophoria is anatomic in origin, how does a child learn to write? It is always by looking with the optical axes to the right. For twenty years this is kept up for several hours a day; will this not result in dextrophoria? We have also to deal with right-eyedness. We are right-eyed just as we are right-handed, 98 per cent of us, and if these children for twenty years learn to write with the optical axes tending to the right, will not that cause this dextrophoric condition? We should change the whole writing position, which is certainly morbid. This question is bound up with right-eyedness and the position in writing, which causes the larger proportion of our 27 per cent of lateral curvatures of the spine. Dextrophoria, I suggest, is caused by long-continued habit. Dextrophoria seems to be a modification of heterophoria, incurable by any operation. We must get back to the cause of it. So long as we write in the habitual position customary with children, so long is dextrophoria a helpful device of nature, and to change it would lead to worse mischiefs.

Dr. L. Howe (Buffalo): I must say that I think a large part of what we are talking about is simply misapprehension of terms. We speak of adduction and abduction, and what do we mean? That simply depends on the way we use the prisms. Ordinarily, we find the adduction to be 6 or 7 degrees, and the abduction 2 degrees less than that. But if you use the revolving prisms, you can bring adduction usually up to 20, if not 30, degrees. It is a question of what we are talking about. As to the method of using the tropometer, I like it very much, and learned very recently it was an old instrument, the principle having been described by Nicati at a meeting of the Biological Society in 1876. We can get the field of fixation better if we put an electric light on one side of a perimeter, steady the head perfectly, and with a small telescope look at the eye and get the reflection from an electric light. But

neither the reading of the tropometer nor of the perimeter is absolutely true. Eyes vary in different individuals in the amount of excursion and the measurements given show many variations. It is not surprising; think how often we have diphtheria and what its after-effects are. When Dr. Valk was asked if the tipping of the head was more on one side than on the other, he said it was much more frequently toward the right. But I am inclined to doubt that, as I have made a considerable number of such examinations, and have never been struck with the fact that this special tendency existed in such a very large percentage of cases. In this connection I think we should keep in mind that while the tipping of the head may be due to a malposition of the spine, this should not be confused with the difficulty of the ocular muscles.

Dr. Colburn: Some two years ago I made a study of the relations of the orbital cavities to the plane of the face, and my impression is that at that time I found that the planes or axes of the cavities were more frequently turned to the right of the median line than to the left. In a series of cases examined it was evident that the patients, from childhood, habitually carried the head to the left, often before beginning to write, frequently tipping down, but very frequently the position of the head would show that the inclination of the orbital lines were to the right, while the habitual pose was in the opposite direction. I have frequently seen an insufficiency of one muscle, in which the pose of the head was toward the weaker muscle, or the whole position and carriage of the body showed the patient was favoring that weak muscle, and not one of the cases I refer to had an inclination of the head toward the right or the direction of the visual lines toward the left, and both eyes were turned in the left direction.

Dr. Knapp: Habit has something to do with shaping our frame, by strengthening the development of our organs, but more important than habit is our birthday-trousseau—I mean our congenital properties—and yet these also may be considered as the consequence of habit. When I made more squint operations (tenotomies) than now, I found that at least in two-thirds of the cases the left eye was more prominent than the right, under the same conditions of operation. In pondering on the cause of this prominent asymmetry, I put my index fingers at symmetrical points of the lower orbital edges, and found that the left orbital margin was more prominent than the right in the majority of cases. Now, what is the cause of this phenomenon, if it is a fact? I have

not counted the cases which I noticed. It is a fact that the children, in more than two cases out of three, have the habit of introducing themselves to their predecessors in the first presentation, *i. e.*, the left part of the head forward.

Dr. Valk (closing the discussion of his paper): I have but few words to say. At our smoker last night one of the speakers said this was the Academy of Ophthalmology; that was the reason I introduced the subject before the members of this society, because I knew they were the best men in the country to consider it, and if it does not meet with you approval, we will understand so much the better. I have my convictions and Dr. Gould has his. I think he will find that the child turns the head to the right. There is the question of whether the cause is anatomical, or rests on the innervation theory, in divergent squint or in convergent squint, but when you come to these well-marked cases of anaphoria, is the innervation theory going to do anything for its correction? If the anatomical theory is true of cataphoria and anaphoria, we might say the same of dextrophoria. If you take a child and put it in a gymnasium and put it to work, and in six months it will have a certain amount of muscular power, but if you stop that exercise the muscles will go back. Winters, of New York, has demonstrated that if you take a child and build up these muscles in the proper way, they will remain as they are. You can get a certain amount of adduction by prism exercise up to 80 degrees, with some individuals. It does not stay there. Why not? In the course of six months you will have it down to the original point, so I cannot see what use we can have for the prism exercise. It will be better for a while, but will go back to the same condition again. Again it comes back to the question of muscle cutting. I do not believe in it, and would seldom do it. In some slight cases a partial tenotomy is indicated, but very few. These muscles are anatomically too weak. Simply increase the power of the muscle anatomically by an operation and it will be permanent. With reference to what Dr. Gould has said, in regard to the one-eyed blind. If he has lost one eye, and you give him anything to look at he will not hold it in front of the perfect eye, but in the median plane. He will hold it right in front of him. Is the remaining eye, then, the dominant one?

FIXED FALLACIES IN OPHTHALMOLOGY.*

By JOSEPH E. WILLETTS, M.D.

PITTSBURG, PA.

If evolution is not applicable to the human race, it is applicable to the profession of medicine, for truly no other profession has so surely evolved itself from nothing. Three hundred years ago, the blood drawn from under the wing of a white pigeon, the left foot of a turtle severed at full moon, and other like, was considered a panacea in certain ills. Rogues, attributing to themselves some supernatural power, and who cared not what mischief they did, so long as it turned to their own profit, practiced their fantastic and supernatural arts upon the credulous. In this dark chaos of sorcery, witchcraft and quackery, medicine was an art alone, not having reached the dignity of a theory, much less that of a science.

If we allow our minds to revert and reflect upon the horrors of an amputation, before the advent of anæsthesia, or the ligature, and compare it with today's painless operation, when we may at will have a localized or complete anæsthesia of the whole body, we are able to appreciate what anæsthesia has done for medicine. Imagine doing an operation for cataract without an anæsthetic!

What inkling did the world have that it would be enabled to view the skeleton through the flesh until, like a flash from Heaven, came the Rœntgen rays. What one of us present dreads diphtheria in these days of antitoxines, and who guesses at the diagnosis of malaria, typhoid fever or leucocytosis, with our present knowledge of blood counts and analyses? It was by strides such as no other profession can boast of that medicine leaped from darkness to dawn.

It is not my intention to dwell upon the origin of benefits of new discoveries, except to say that the advance of medicine has been so rapid that the profession, in keeping pace, has had no time to dispense with the obsolete theories and debris that silently swirl in the eddies of the stream of progressive medicine. It was the dreamers' superstition and the theorists, that entrenched medicine in the land of nowhere for more than two hundred years. It remained for practical hands to revolutionize and to restore it from the theoretical to a scientific basis, and its future progress is not so much dependent upon new discoveries as it is upon the careful sifting of the evidence at hand and the elimination of its errors.

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*Read at the 10th annual meeting of the American Academy of Ophthalmology and Oto-Laryngology, Buffalo, Sept. 14th to 16th, 1905.

Errors are more detrimental to progress than ignorance. For that which we do not know, we have a blank page to write upon, but a page scribbled with errors must first be erased. Medicine now deals with facts, not fancies.

This change from the theoretical to the scientific must be accredited to specialized medicine. The specialists' opinion cannot be evasive, it must be decisive, authoritative. One cannot become expert in any specialty, with fallacy and error for teachers. Fallacy and error, when found, must consequently be eliminated. It is this elimination by the specialists that makes them experts. It is this elimination of theory by the specialist, that has made the "New Medicine." Error committed in one's private practice may be corrected and no one the wiser, but error in a text book is capable of doing incalculable damage.

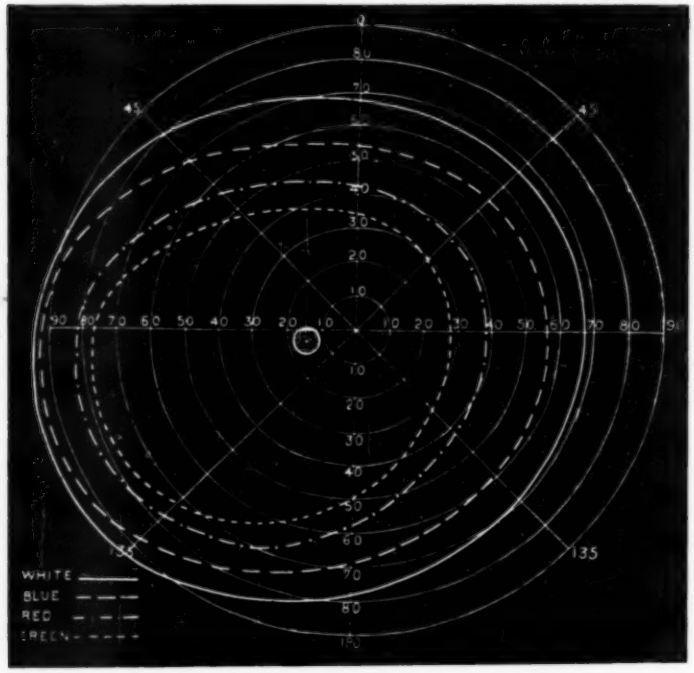
From time to time, various theories have been advanced to account for the phenomena of color perception. The original theory of Thomas Young (1807) supposes the retina to contain three (3) sets of color-perceiving elements: one for red, one for blue and one for green, and further says that the blindness for any one of said colors indicates an absence or paralysis of said element for said color. According to the teachings of the text books, the perimeter shows that the greatest contraction of the field of vision for color, is that of green. This zone extends upward 27 degrees, inward 25 degrees, downward 30 degrees, outward 50 degrees, and includes central vision. As we recognize all color with our central vision, why teach that this area of the retina is composed of percipient elements specially adapted for green? Why block out an area for blue and red, when said colors are perceived in the green zone and *vice versa.* Why teach that there is a contraction of the field of vision of the normal eye for various colors?

On page 32, Fuchs' second edition, is the following:

"If the examination of the field of vision for color be made with the ordinary test objects used with the perimeter (color squares of paper, one to two centimetres in diameter) the most peripheral portions of the retina are found to be color blind."

The peripheral portion of the retina is intended for orientation alone. Its pericipient elements are the same, histologically, as those at the fovea centralis, but more widely separated. We see a moving horse from the corner of our eye, but we do not see its color, true, nor do we see its harness, (which belongs to the form field) until we fix our central vision upon it. The condition for physical sight is light, all objects are seen by reflection. If we

choose to diminish the light and reduce the object, to suit man's invention, we may do so, but no writer of a text book should take the liberty of altering the function of the retina to suit the instrument, which in this instance is the perimeter. The perimeter demands that we employ colored squares not exceeding two centimetres in size, so that the field may conform with its own powers. It also demands that we ignore an error of 6 degrees and 97′, due to the compulsory convergence for so near a point of fixation.



This known error may be added to the net result, but the error caused by the physiognomy (which varies in each individual) and the personal equation, (which varies with the intelligence of the patient) are unknown quantities.

In 1896, I constructed a cone-shaped, hexagon prism, with its sides cut at an angle of 73 degrees, 40′, made of flint glass, with an index refraction of 1.584, which deflected six lights upon the retina at an angle corresponding to the degree of 70 degrees, as taken by the perimeter.

With this instrument, the error of 6 degrees, 97′ made by the perimeter, and also that caused by the physiognomy, was avoided.

Formula for a prism in the position of minimum deviation.

Let n = index of refraction
A = angle of prism
d = min. deviation

To find d,—$\sin \frac{1}{2}(A+d) = n \sin \frac{1}{2} A$.

To find A,—$\cot \frac{1}{2} A = \frac{n - \cos \frac{1}{2} d}{\sin \frac{1}{2} d}$

Formulæ for a prism when the incident ray is perpendicular to the second face of the prism.

Let n = index of refraction
A = angle of prism
d = deviation

Given A to find d.

$$\sin r = \frac{\sin A}{n}$$

$$r' = A - r$$

$$\sin d = n \sin r'$$

Given d to find A.

$$\sin r' = \frac{\sin d}{n}$$

$$\cot r = \frac{n - \cos r'}{\sin r'}$$

$$A = r' + r'$$

Example:—n = 1,584, A = 75°, to find d

log sin A - - -	9.9849
log n - - - -	0.1998
log sin r - - -	9.7851, r = 37° 34′

r′ = 75°—37° 34′ = 37° 26′

log sin r′ - - -	9.7883
log - n - -	0.1998
log sin d - - -	9.9836, d = 74° 21′

Example:—n = 1,584, d = 75°, to find A

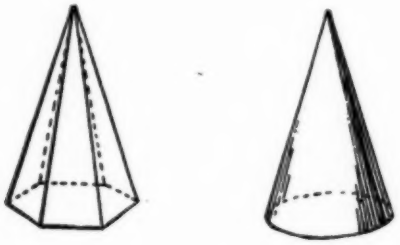
log sin d - - -	9.9849
log n - - - -	0.1998
sin r′ - - -	9.7851, r′ = 37° 34′
n =	1.5840
Nat cos r′ - - - =	0.7926
n— cos r′ - - =	0.7914,—log 0.7914—9 8984
	log sin r′ —9.7851
	log cot r —0.1133

r = 37° 37′
A = 37° A34′ + 37° 37′ = 75° 11′

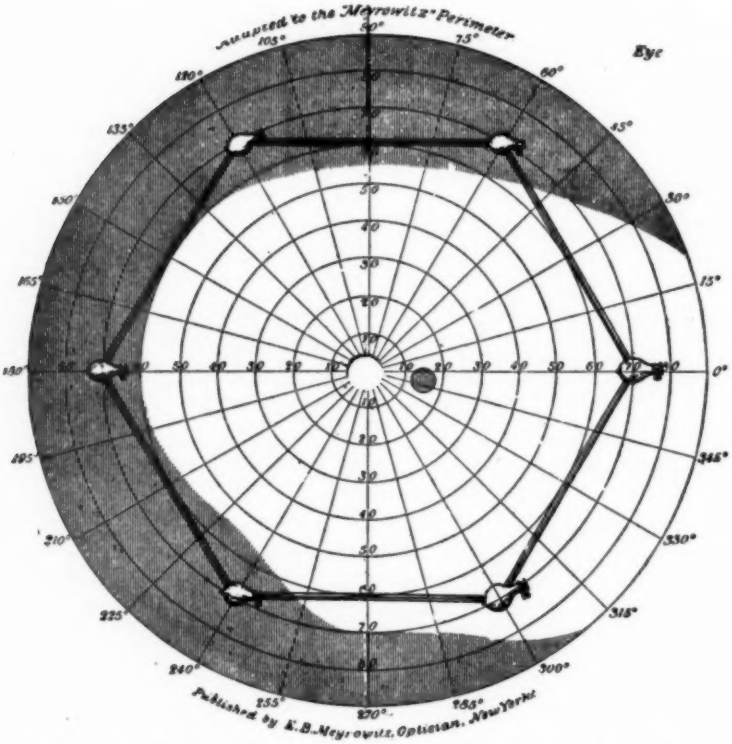
Noyes says, page 29, edition 1890:

"Outside of the field for yellow, only blue can be seen; and outisde of the field for blue, no color is recognized."

Fuchs, on page 23 (Figure 13), says that the anterior border of the sensitive portion of the retina extends farther forward in the nasal side than on the temporal, in comparison as 65 degrees is to 90 degrees.



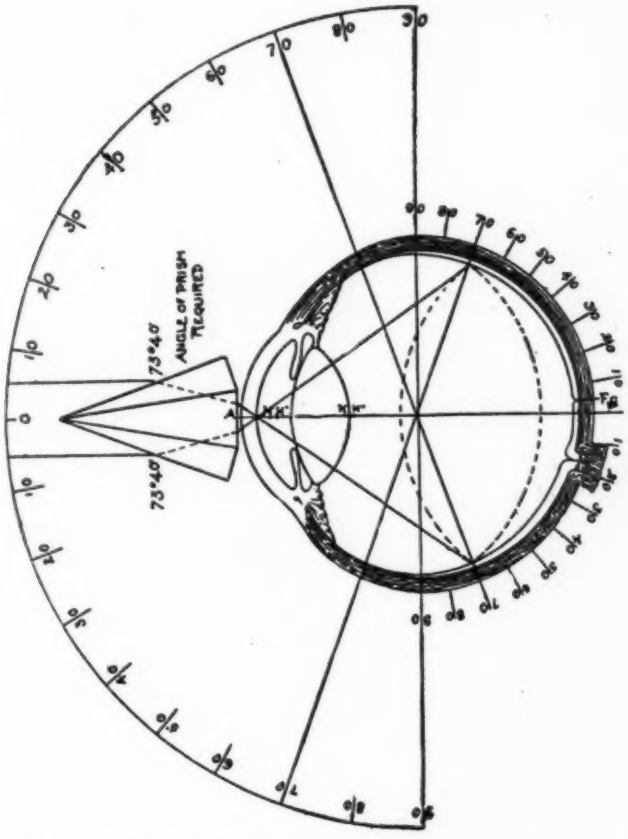
Author's cone and hexagon-prism, consisting of six prisms, cut at an angle of 69 per cent. combined as a whole.



A rough drawing of the retinal images, as seen with the higher degree hexagon-prisms.

The prismatic perimeter has proved both of these statements to be incorrect. Outside of the field for blue, (which does not

exist) all the colors of the spectum are discernable and recognizable, and the sensitive portions of the retina, are equi-distant in all of its meridians. The temporal portion of the retina perceives form and all colors at 90 degrees (the same as the nasal portion), if it be permitted to do so. The perimeter does not give this portion of the retina the opportunity, consequently, its function has been assumed negative, to conform to an incapable instrument.



Author's descriptive PLATE I. Illustrating the *modus operandi* of the prismatic perimeter.

One must take into consideration the varying degrees of light stimuli, in making an examination of the field of vision, but why make it the minimum, as we must do with the perimeter.

The diseases of the eye, which produce a contraction of the field of vision for form and color, are retinitis pigmentosa, glaucoma, optic atrophy and hysterical amblyopia, but by the time that this

contraction of the field is narrowed down to the requirements of the perimeter, the diagnosis, with the exception of hysterical amblyopia, is so apparent with the ophthalmoscope, that the one that takes the field to verify it, must indeed be sceptical.

If there is any one thing that the student of ophthalmology ought to be able to tie to, it is his text book. It should be stripped bare of theoretical deductions. It should be an absolute authority and contain nothing but demonstrated and absolutely incontrovertable fact. Bald fact, not theory. Surely not error.

The object of this paper, Mr. President, is to present a plea to a representative body for the careful revision of the color scheme by writers and the elimination of that inaccurate and misleading chart, which teaches a contraction of the normal field of vision for color.

DISCUSSION.

Dr. Spalding (Portland, Me.): I have been much interested in the paper, and if Dr. Willett's conclusions are true, and I have no reason to doubt them, it shows what errors will creep into the text books and remain, in spite of anything we can do. I think there are many others in the text books and that they might be studied with benefit. One is that atropine conjunctivitis is common. I have never seen a case in thirty years. Another is that eserin will contract any pupil; sometimes the pupil is so rigid it will not contract. It seems to me we do not study colors sufficiently, considering the importance attached to that portion of the sight. I had a patient in whom the sight for green and red, when contrasted together, was lost; for instance, in the autumn, when the leaves of the trees are so magnificently colored and the red leaves are sometimes mingled with the green. This gentleman has told me that looking at a lady's dress, green, printed with red flowers, that the moment he looks with his astigmatic eyes the red fades away and there is nothing but the green. It shows that astigmatism may be produced by changes in the choroid, which pressing on the color-perceiving rods and cones in the retina destroy color perception. A lady patient had an astigmatism at 90 degrees. The perception of the left eye for red was good. She had for this eye a plain cylinder, axis 90. She returned to me in great distress with an effusion at the yellow spot and great confusion in distinguishing colors. That patient's astigmatism had changed from 90° to 165°. In the course of three or four weeks it gradually swept back and today is 90°. This patient had the same trouble in

her left eye, confusion of red and green, as mentioned in the case of the gentleman, though not so marked. I think that all of us ought to make the time to study more about colors, color contrasts and examination for colors. This paper that has been read to us ought to be an incentive to us to discover further uses for color tests, and further truths as to the perception of color. Finally, the text books should be investigated for other fixed fallacies in ophthalmology.

Dr. Heckel (Pittsburg): I do not think there is any doubt about the fact that the field for colors is restricted anatomically, and that many an error has crept into our text books. I do not think there is any doubt but that color perception depends upon intensity. An English writer (Abney) has written a book with a number of experiments which brings this out clearly. In tobacco amblyopia, for example, it is well known that if we reduce the illumination we markedly reduce the visual acuity, and *vice versa.* The perimeters which have been invented with electric lamps completely defeat the purpose for which they were intended. The intensity of the color is so great that it utterly fails to reveal pathological constrictions of the field of vision. Recently, while looking over the literature to find something on electric ophthalmia, I ran across a statement in one of the books, about snow blindness, which stated that it "is in reality a disease of the conjunctiva," and is produced by the heat reflected from the snow. We know that we can have no light without heat, but the amount of heat reflected under these circumstances must be infinitely small. We also know that the blindness is not due to the conjunctival condition, but is the result of retinal exhaustion.

Dr. Willetts (closing discussion): The hexagon prism has proven conclusively that there is no such a thing as a contraction of the field of vision for red, green, or blue, as at present taught by all text books. It has proven it mathematically, and has given a method by which we may express its findings in a scientific way, instead of the present indefinite manner. Any member present may prove to himself, in a few minutes, that all colors are recognizable at the periphery at 80, and even 90 degrees, by turning on various colored electric lights and standing in line with the same with the face and eyes fixed at right angles with the light. The hexagon prism deflects to 70 degrees only sufficiently far to prove the fallacy of the Young-Helmholtz theory, which is inconsistent, unscientific and without a single iota of evidence to sustain it.

UNDERGRADUATE INSTRUCTIONS IN DISEASES OF THE EYE.*

By L. A. W. ALLEMAN, A.M., M.D.
BROOKLYN, NEW YORK CITY.

Specialization of knowledge and centralization of control are the signboards directing the man of today on the road of maximum efficiency to the goal, Success.

No individual, no class, escapes the influence of the spirit dominating the age.

The knight no longer rides forth to battle cased in armor, at the head of his retainers, trusting to brute force and courage to gain the victory.

Today victory comes to the man who thinks. As an illustration, take the story that comes to us of the recent campaign in Manchuria.

Contrast the two commanders, Kuropatkin striving bravely but blindly, in the thick of the fight, ignorant of the disposition of his own and the opposing forces, and fearing as much the insubordination of his own officers as the bullets of the enemy.

Opposed to him we have a cool intelligence. Far from the turmoil of the engagement Oyama sits in his tent, utilizing all the aid offered by modern science to keep in touch with every part of his command; confident of the ability and obedience of every man under him, he is free to concentrate his powers upon the problem before him and to cöordinate and direct the ability and courage of every man in his command to carry out the plan which his genius has conceived.

In the no less serious battle we, as physicians, are called upon to fight, in our efforts to save life and alleviate life's miseries, we may well learn a lesson from the profession which aims at life's destruction.

The physician of today who fails to avail himself of the assistance offered by the skill and knowledge of those of his confrères who have devoted their lives to the study and practice of the special branches of our profession, is as much an anachronism as a Don Quixote tilting at shrapnel; and, on the other hand, a so-called "specialist," who forgets that he is a "Physician who confines his practice to a special branch," and that no part of the body can be successfully treated without reference to the rest of the

*Read at the 10th annual meeting of the American Academy of Ophthalmology and Oto-Laryngology, Buffalo, Sept. 14th to 16th, 1905.

economy, is as dangerous as the officer who attempts to fight his command without regard to the plans of his superiors. These are all simple and self-evident propositions, and it may seem to you absurd to consume your valuable time with a reiteration of facts which no one will dispute, but my excuse is, that as a matter of cold fact, the most serious danger confronting our profession today, the one thing which does most to discredit the profession with the laity, is narrow specialism; a failure to grasp the proper cöordination of a general and special medicine, and the text that I preach to myself and to my students, in season and out of season, is "DON'T *be a Specialist.*" This text I should like to see inscribed on the door post of every medical school, just below the other, *"Be Honest."* These two are fundamental, and are essential to an honorable success in our profession, be we surgeons, practitioners of general medicine, or so-called specialists.

It is a most difficult task, to discuss the subject which I present apart from that of medical education in general.

The utter and absurd lack of agreement, both as to the time required for a proper preparation for professional work, as well as to the proportion of this time which should be devoted to each branch,* renders some formulation of a standard of requirement

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*From Webster: Curricula of American Medical Colleges (*New York and Philadelphia Medical Journal*, July 23, 1904):

Some of the specialties are given an undue prominence, and an unmerited allowance of time in some of the schools; for example, 780 hours to orthopaedic surgery by the University of Nebraska; 570 hours to gynaecology by the Medical College of Ohio; 330 hours to aetiology and hygiene by the College of Physicians and Surgeons, Chicago; and 448 hours to dermatology and syphilis by Barnes Medical College, in St. Louis.

Further study of the statistics collected, but not included in this report for want of space and time, would readily disclose much useful information in regard to the relative time devoted to clinical teaching. This varies almost as widely as does the relative time devoted to each subject.

GENERAL MEDICINE:—Highest, Atlanta College of Physicians and Surgeons, 1,900 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 490 hours.

GENERAL SURGERY—Highest, Atlanta College of Physicians and Surgeons, 2,221 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 536 hours.

ORTHOPAEDIC SURGERY:—Highest, University of Nebraska, 780 hours; lowest, Long Island College Hospital, 13 hours. Average, 61 hours.

OBSTETRICS:—Highest, University of West Tennessee, 460 hours; lowest, Physio-Medical College of Texas, 52 hours. Average, 169 hours.

PATHOLOGY—Highest, Chattanooga Medical College, 646 hours; lowest, Willamette University Medical Department, 48 hours. Average, 251 hours.

almost a prerequisite to a consideration of the proper course in any specialty. I quite agree with the position taken by Dr. Jackson, in his able address, before this Association at the last annual meeting. The time devoted to preparation for professional work already seriously encroaches on the best years of a man's life, and I also agree with him in deploring the lack of opportunity for proper preparation for work in our special branch, afforded by medical institutions. Possibly there are opportunities for a man to become skilled in our special work, of which I am ignorant, but personally, I know of no other means of obtaining this training, save by work as an assistant in the office of some competent practitioner. What the remedy is, and what we should do about it, are problems which are respectfully turned over to the man who has solved them; I am satisfied, however, that they will not be solved by an increase in the time devoted to technical and purely special instruction in a course, the object of which is to prepare a man to become an all-around practitioner of medicine. I must confess that my own views on medical education have radically changed. At one time I regretted that I had not taken the college course preparatory to medicine, rather than the course in arts, but, should my son choose to follow me in our profession, I should

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ANATOMY:—Highest, University and Bellevue Hospital Medical College, 1,248 hours; lowest, Physio-Medical College of Texas, 126 hours. Average, 480 hours.

HISTOLOGY & EMBRYOLOGY:—Highest, Ensworth Medical College, 540 hours; lowest, Physio-Medical College of Texas, 26 hours. Average, 211 hours.

PHYSIOLOGY:—Highest, Atlanta College of Physicians and Surgeons, 750 hours; lowest, University of Virginia, 56 hours. Average, 341 hours.

CHEMISTRY:—Highest, University of Nebraska, 756 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 345 hours.

BACTERIOLOGY:—Highest, Chattanooga Medical College, 606 hours; lowest, Eclectic Medical College, New York, 20 hours. Average, 138 hours.

PAEDIATRICS:—Highest, Illinois Medical College, 392 hours; lowest, University of Virginia, 18 hours. Average, 98 hours.

PHYSICAL DIAGNOSIS: Highest, Atlanta College of Physicians and Surgeons, 475 hours; lowest, Melharry Medical College, 20 hours; and Oakland College of Medicine and Surgery, 20 hours. Average, 97 hours.

GYNAECOLOGY:—Highest, Medical College of Ohio, 570 hours; lowest, University of Nebraska, 32 hours. Average, 181 hours.

AETIOLOGY & HYGIENE:—Highest, College of Physicians and Surgeons, Chicago, 330 hours; lowest, Columbian University, 8 hours. Average, 46 hours.

NEUROLOGY:—Highest, University of Michigan, 327 hours; lowest, University of Tennessee, 10 hours. Average, 83 hours.

strongly urge him to shape his preliminary education, to broaden, rather than to narrow his field of knowledge. If a student can bring to the study of his profession, a mind trained to depend upon itself, to run on a broad gauge, and if he has cultivated his powers of observation and concentration, he has, in my judgment, an ideal equipment.

Our aim is not to teach our students mere facts—we all know men of great knowledge who are failures; we should teach applied science; we should prepare the men, as best we can, for the unforeseen emergencies; in a word, we should teach them to think and act for themselves. How, then, can we best shape the course of instruction in diseases of the eye to equip a man to meet those cases which will of necessity come under his observation in general practice?

The increase in the number of hours devoted to a preparatory course has not been ideally divided. Surgery, for example, is, in many institutions, taught as a specialty. It seems to me as absurd to endeavor to equip a man, at graduation, with the ability to do abdominal surgery, as to make him a competent operator for cataract.

As it is impossible for us to reconstruct the college course to suit our own ideas, the problem is to make the best use of the time

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MENTAL DISEASES:—Highest, Western Reserve University, 268 hours: lowest, Bowdoin College, 6 hours. Average, 46 hours.

MATERIA MEDICA & THERAPEUTICS:—Highest, Hering Medical College, Chicago, 832 hours; lowest, Physio-Medical College of Texas, 52 hours. Average, 216 hours.

PHARMACOLOGY:—Highest, American Medical Missionary College, 330 hours; lowest, University College of Medicine, Virginia, 12 hours. Average, 60 hours.

DERMATOLOGY & SYPHILIS:—Highest, Barnes Medical College of St. Louis, 448 hours; lowest, University of Missouri, 10 hours. Average, 80 hours.

LARYNGOLOGY & RHINOLOGY:—Highest, Atlanta College of Physicians and Surgeons, 450 hours; lowest, Long Island College Hospital, 15 hours. Average, 85 hours.

OPHTHALMOLOGY & OTOLOGY:—Highest, College of Homoepathic Medicine, University of Iowa, 432 hours; lowest, Melharry Medical College, 16 hours. Average, 124 hours.

MEDICAL JURISPRUDENCE:—Highest, National Medical University and Hospital, Illinois, 775 hours; lowest, College of Medicine, Syracuse University, 4 hours. Average, 36 hours.

GENITO-URINARY:—Highest, Barnes Medical College, 448 hours; lowest, Melharry Medical College, 4 hours. Average, 74 hours.

GRAND TOTALS:—Highest, Atlanta College of Physicians and Surgeons, 10,124 hours; lowest, Physio-Medical College of Texas, 958 hours. Average, 4,257 hours.

AVERAGE NUMBER OF MONTHS:—Seven plus.

assigned us, and this I believe will be best accomplished by teaching Ophthalmology, not as a specialty, but as an important and necessary part of a general medical education. I do not believe that one man in fifty, in this society of so-called specialists, had, previous to the time of his graduation, decided upon the special line of work that he is now following, and even had the large proportion of the men decided to enter special practice immediately after graduation, they would nevertheless have needed training in the general principles of other branches than their own. For this reason my endeavor is to teach in the undergraduate course only such subjects as are of interest to the practitioner of general medicine.

The method of teaching must be individual; no one can succeed by another's plan, and each must choose the method best suited to his own peculiarities and abilities.

The scheme of instruction which I personally attempt to carry out consists of clinical instruction which is given by the chief of clinic and of my didactic lecture. I fully realize the importance of clinical work, but I find that patients in the amphitheatre, during the lecture hour, divert the attention of the students, and it is not possible to allow a large body of men to personally examine cases during the lecture without confusion.

In the didactic lectures I set before myself the task of teaching the students to divide the cases, which they shall be called upon to treat, into two classes, one consisting of those that can be safely and properly handled, without special knowledge or special apparatus, the other those serious and dangerous cases, in which they should obtain expert assistance at once, and if this is impossible, to instruct them in such first aid as may be necessary, until the assistance of a specialist can be obtained.

As far as possible, the technicalities and such terms as are peculiar to our branch are omitted, and at the conclusion of the lecture the students are given slips with the explanation of the technical terms used in the day's lecture, with a summary of the more important points treated.

It is not so long since I, myself, sat upon the benches that I have forgotten the lectures on special subjects from which I suffered in my college days, and I then promised myself, should I ever be called upon to instruct a medical class, that I should earnestly endeavor to say what I wanted to teach the students in a language which they could understand. We should talk down to the level of the average student, and it is useless to attempt to

teach too much.

My lecture hour is on Friday afternoon, and the men are tired with a hard week's work, and I realize the inability of the human mind, in such a condition, to retain an hour's lecture which is all meat. At the end of the hour the students will know more, if you have repeated yourself and have told them the more important facts in several different forms, and have clinched these facts by illustrations.

The selection of the essentials for the course of instruction is a matter again largely of personal judgment, and the things omitted are quite as important as the things taught. My own theory is that such facts as are plainly stated in all text books on the eye, and that can be learned by the student as well at home as in the lecture room, should be omitted. I consider it a waste of valuable time to teach any subject as I have frequently heard anatomy taught. A lecturer who stands before his class and simply repeats page after page from a text book is wasting his own and the student's time. I do not wish the student to learn the use of the ophthalmoscope save only for the detection of foreign bodies and opacities of the lens. Granted that a student should become expert enough in the use of the ophthalmoscope to be able to obtain some assistance from it at the time of his graduation, the chances are largely against his having sufficient opportunities in general practice to keep himself up to the standard which he had at first obtained, and the ophthalmoscope in the hands of a man who knows just a little about its use, is a dangerous instrument.

The points which I especially strive to impress upon the student are, the assistance that he may expect from an examination of the eye in forming a general diagnosis;—the necessity for recognizing ocular disorders as a factor in the causation of general disease;—the systemic causation of many diseases of the eye, with an insistent reiteration of the symptoms of those diseases requiring prompt and efficient treatment for the preservation of vision;—the importance of a routine examination of all cases;—and the necessity of the ability to detect and remove foreign bodies;—to recognize contagious diseases of the conjunctiva are insisted upon, and special stress is laid on the prevention of ophthalmia-neonatorum;—the differential diagnosis of conjunctivitis and iritis;—the use and dangers of atropia;—the prodromal symptoms of glaucoma;—the dangers of sympathetic ophthalmia,—and the duty of the physician in the prevention of such diseases as interstitial keratitis, and the other lesions of inherited syphilis.

Such vital matters as these I try to impress upon the men until they can never forget them, if they would. Optics and refraction are only taught in outline, and with a view of enabling a man to understandingly instruct his clients in the care of their own and their children's eyes. The prevention of myopia and the correction of squint by glasses and the proper position for study and other points of ocular hygiene are briefly mentioned. In brief, my endeavor is to equip a student to be a competent medical adviser to his clients and competent to practice the most important branch of our profession, namely, preventive medicine.